CLASS PROGRAMME

Type approval


Synthetic fibre ropes for towing, mooring and anchoring
FOREWORD

DNV GL class programmes contain procedural and technical requirements including acceptance criteria for obtaining and retaining certificates for objects and organisations related to classification.

© DNV GL AS March 2016

Any comments may be sent by e-mail to rules@dnvgl.com

This service document has been prepared based on available knowledge, technology and/or information at the time of issuance of this document. The use of this document by others than DNV GL is at the user’s sole risk. DNV GL does not accept any liability or responsibility for loss or damages resulting from any use of this document.
CHANGES - CURRENT

This is a new document.
## CONTENTS

### Changes - current

- Section 1 General
  - 1 Introduction
  - 2 References
  - 3 Documentation

- Section 2 General Requirements
  - 1 Design requirements
  - 2 Requirements to production and quality control arrangement
  - 3 Description of type testing
  - 4 Requirements to material
  - 5 Requirements to marking of product

### Changes – historic
SECTION 1 GENERAL

1 Introduction

1.1 Objective

The objective of this class programme (CP) is to describe the type approval (TA) scheme for synthetic fibre ropes for towing, mooring and anchoring.

The general requirements for obtaining DNV GL type approval certificate is given in class programme DNVGL CP 0338 Type approval scheme.

The procedures and requirements described in this CP are applicable for obtaining TA certificate based on requirements given by the Society’s rules and standards.

Guidance note:
This class programme is not applicable for obtaining EU Marine Equipment Directive (MED) certificates. Visit www.dnvgl.com for information on MED certification.
Please note that buoyant fibre ropes are not allowed for anchoring of HSLC.
This type approval programme does not cover fibre ropes for offshore moorings, for deep sea lifting nor for SPM Hawser

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

1.2 Scope

This CP gives a description of the procedures and requirements related to documentation, design and type testing applicable for TA of synthetic fibre ropes for towing, mooring and anchoring.

This CP does not set the design requirements to the synthetic fibre ropes for towing, mooring and anchoring. TA is based on compliance with design requirements given in the rules and/or other regulations and standards. The CP describes how to document compliance with the requirements in order to obtain a TA certificate for the equipment. This includes, where relevant, technical requirements for how the type tests shall be performed.

The Society’s type approval certificate will cover one grade of the actual product with the possibility to include variants.

For synthetic fibre ropes this means:

— **Grade**: ropes made of different fibres (e.g.: polyamide, polyester, polypropylene, polyethylene) are considered different grades. In addition different qualities within each type of material are considered different grades, e.g. different polyethylene qualities (low density, high density, ultra high density, etc.) will be considered different grades. Braided and laid ropes are also considered different grades

— **variants**: Different constructions (e.g.: 3-strand, 4-strand, 6-strand, etc.) and different dimensions (diameters) are considered as variants.

One DNV GL type approval certificate is normally limited to one manufacturer at one production site, however, other arrangements may be agreed upon with the Society.

The following properties/information will be printed in the type approval certificate:

— fibre type/material
— specific gravity
— all types of constructions
— all dimensions or range of dimensions, e.g. diameter, circumference, etc.
— net mass per metre
— minimum breaking load
— the product standard/specification (see Sec.2 [3]) to which the rope is found to comply
— test standard(s).
The type approval programme covers only the rope itself, and only the aspects covered in the standards (as listed in Sec.2 [3]).

Type tests as specified in Sec.2 [3], are to be carried out and verified in one of the following ways:
— at a DNV GL laboratory
— at a recognized and independent laboratory or a laboratory accepted by the Society
— at the manufacturer’s premises in the presence of a surveyor.

1.3 Application

The type approval certificate will state the following application areas:
— mooring and towing of ships
— mooring, towing and anchoring of HSLC.

2 References

Standards referred to in this document:
— ISO 9001:2008, Quality management systems - Requirements
— ISO 1140, Fibre ropes -- Polyamide -- 3-, 4-, 8- and 12-strand ropes
— ISO 1141, Fibre ropes -- Polyester -- 3-, 4-, 8- and 12-strand ropes
— ISO 1346, Fibre ropes -- Polypropylene split film, monofilament and multifilament (PP2) and polypropylene high-tenacity multifilament (PP3) -- 3-, 4-, 8- and 12-strand ropes
— ISO 1969, Fibre ropes -- Polyethylene -- 3- and 4-strand ropes
— ISO 2307, Fibre ropes -- Determination of certain physical and mechanical properties
— ISO 10556, Fibre ropes of polyester/polyolefin dual fibres
— ISO 10572, Mixed polyolefin fibre ropes

3 Documentation

For TA of Synthetic fibre ropes for towing, mooring and anchoring, the following additional documentation shall be submitted by the manufacturer at initial type approval, and updated at renewal (general documentation requirements are given by DNVGL CP 0338). The documentation shall, to the extent possible, be submitted as electronic files. The manufacturer shall keep one (1) copy of type approval documentation in their own file. The documentation that forms the basis for the TA shall be easily available for surveyors at the TA applicant’s premises. When documentation is submitted in paper format, normally two copies of the documentation shall be submitted to the Society. No documentation will be returned to the company applying for TA.

Please number documentation according to below list to facilitate review:

1) type designation, i.e. product name (grade) with list of variants to be included in and stated on the type approval certificate
2) Basis for approval. A reference to applicable rules and standards, see Sec.2 [1], which the product shall comply with
3) product specification/description, and data sheet for all variants, including:
   — material specification (yarns and fibres), i.e.:
     — yarn and fibre designations,
     — yarn and fibre description and
     — characteristic properties for both yarn and fibre
   — rope construction, e.g. traditionally twisted, low twist, braided, parallel yarn, etc.
— number of parts
— weight variants
— all dimensions, e.g. diameter and/or circumference, etc.
— dry breaking strength
— density of the rope, i.e. buoyant or non-buoyant in sea water
— for fibre qualities not covered by the standards listed in Sec.2 [4.2] documentation on the following properties may be required by the Society:
  — dry breaking strength
  — wet breaking strength
  — fatigue strength
  — creep characteristics
  — abrasion resistance
  — documented environmental resistance.

A type approval will in such case be subject to evaluation of this documentation.

4) Field of application and operational limitations (e.g. avoid sharp edges, minimum bend radius, precautions w.r.t. abrasion, etc.) of the product

5) product specification, including data sheets (TDS and MSDS) for all variants

6) description of production processes, including standard operating procedures (SOP)\(^1\)

7) description of quality assurance system or copy of ISO 9001 certificate

8) quality plan for material intended to be installed on board ships\(^1\)

9) test results (from tests already carried out) with references to standards, methods etc.

10) information regarding marking of the product or packaging\(^1\)

11) any relevant certificates with their issue number and/or date (e.g. quality management system certificate).

12) list of test and measuring equipment, including calibration certificates\(^2\)

13) in-service experience, if available

14) witnessed type test results and initial assessment report by DNV GL local office shall be submitted when completed.

\(^1\) to be verified by initial assessment prior to issuance of type approval certificate
\(^2\) to be verified by surveyor during type testing
SECTION 2 GENERAL REQUIREMENTS

1 Design requirements
The synthetic fibre ropes for towing, mooring and anchoring shall comply with the relevant rules as given in Sec.1 [1.1].

2 Requirements to production and quality control arrangement
The manufacturer should have a quality system that meets ISO 9001 standards, or equivalent. If this quality standard is not fulfilled, the extent of type testing and assessments will be specially considered. The quality control arrangement in production shall be checked with respect to:
- control of incoming materials
- scope of quality control, i.e. proof that test methods, test quantity and test equipment complies to the applicable standard EN or ISO
- traceability and marking system
- production records
- storage condition and procedure.

3 Description of type testing
Type testing shall be carried out during initial approval, and additional tests shall be repeated during renewal of a type approval certificate. See [4].

4 Requirements to material

4.1 General
The tests and requirements are to be in accordance with [4.2].
The class programme refers to various standards dependent on fibre rope material and quality, see Table 1.

4.2 Requirements to fibre materials and ropes
4.2.1 The quality of the fibre rope material shall be in accordance with one of the following standards

Table 1 Rope standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 1140</td>
<td>3-strand hawser-laid and 4-strand shroud laid ropes, 8-strand and 12-strand braided ropes (polyamide)</td>
</tr>
<tr>
<td>ISO 1141</td>
<td>3-strand hawser-laid and 4-strand shroud laid ropes, 8-strand and 12-strand braided ropes (polyester)</td>
</tr>
<tr>
<td>ISO 1346</td>
<td>3-strand hawser-laid and 4-strand shroud laid ropes, 8-strand and 12-strand braided ropes (polypropylene)</td>
</tr>
<tr>
<td>ISO 1969</td>
<td>3-strand hawser-laid and 4-strand shroud laid ropes (polyethylene)</td>
</tr>
<tr>
<td>ISO 10556</td>
<td>3-strand hawser-laid, 8-strand and 12-strand braided fibre ropes (polyester in combination with polyolefin)</td>
</tr>
</tbody>
</table>
4.2.2 If the rope is produced of a fibre or a construction which is not covered by one of the listed standards, a rope specification shall be submitted by the manufacturer. The specification can be the manufacturer’s specification, that is, a formal document accepted by the Society, including date and revision number, containing similar information as in:

a) the listed product standards (e.g. ISO 1140), i.e.:
   - fibre specification
   - construction
   - net mass per metre, including tolerances
   - dry breaking strength, shall be specified based on a satisfactory statistical basis, e.g. 10 full scale tests (the manufacturer shall aim at specifying a minimum breaking strength equal to the lower 95% confidence limit of the breaking strength).

or/and

b) OCIMF:
   - fibre specification
   - construction
   - net mass per metre, including tolerances
   - new dry breaking strength and
   - new wet breaking strength, shall be specified based on a satisfactory statistical basis, e.g. 10 full scale tests (the manufacturer shall aim at specifying a minimum breaking strength equal to the lower 95% confidence limit of the breaking strength).

4.2.3 Other standards or specifications may be found acceptable after an evaluation by the Society. The language of the standard shall be English.

4.3 Extent of type testing

The manufacturer may choose to carry out testing according to one or more of the alternatives described below.

The extent of type testing for synthetic fibre ropes is listed in Table 3.

The test report shall contain references to test procedures used and all test results.
4.3.1 Alternative 1 1)
Type testing according to the following standards:

Table 2

<table>
<thead>
<tr>
<th>ISO 2307</th>
<th>Fibre ropes - determination of certain physical and mechanical properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Others standards may be used, such as e.g. international or national rope test standards, accepted by the Society</td>
<td></td>
</tr>
</tbody>
</table>

For each rope diameter at least two samples shall be tested.
Ropes of two different diameters shall be subjected to testing for each type of rope subject to approval, one with the largest diameter to be included in the type approval certificate and one with a diameter representative for the major part of the production.
If the ropes are divided into several ranges (due to different rope constructions) of diameters, the largest diameter shall be included in the type approval certificate and one diameter of each of the smaller “designs” (i.e. ranges) shall be tested.
The following tests and measurements according to ISO 2307 shall be included in the type testing:
— net mass per metre
— lay length
— plait pitch
— diameter and/or circumference
— breaking strength, and
— elongation.
Initial setting of the rope, inclusive splices, by cyclic loading prior to testing of breaking strength shall be carried out in accordance with the test standard. Testing of breaking strength shall be carried out with a monotonously increasing load until failure of the rope.
Any test piece which breaks outside the marks (i.e. in the splice area) is considered to comply with the tensile strength specifications if the force recorded on breakage is not less than 90% of the minimum specified breaking strength. The location of the failure and the breaking force recorded during the test shall be reported.

Guidance note:
If requested by the customer, please note that ISO 2307:2010 provides a method for measuring water repellency, lubrication and finish content, and heat setting treatment.

4.3.2 Alternative 2
As an alternative the manufacturer may carry out testing according to a different standard e.g.:
If the ropes are divided into several ranges (due to different rope constructions) of diameters, the largest diameter shall be included in the type approval certificate and one diameter of each of the smaller “designs” (i.e. ranges) shall be tested.
Tests and measurements according to OCIMF cover the following items:
— new dry break test (NDBS) 2)
— new wet break test (NWBS) 2)
— cyclic load test 3)
— elongation and extension measurements.

2) Initial setting cycles prior to break test: Initial setting of the rope shall, after having been loaded to the reference load, be carried out by cycling the rope ten times from the reference load to 50% of its estimated NDBS and NWBS, respectively, at a suitable loading rate not less than 5% of the overall specimen length per minute with no rest between cycles.
3) Cyclic load test: The manufacturer may select not to test this item. However, cyclic load testing is recommended for synthetic fibre ropes to be used in applications subject to cyclic loading.

a) If cyclic load testing has not been carried out, the following will be added to the application text on the type approval certificate:
   Cyclic load properties have not been verified.

b) If cyclic load testing has been carried out, and the results found to be satisfactory, the following will be added to the application text on the type approval certificate:
   Cyclic load properties have been verified, and are listed in the certificate.

The results of the cyclic load testing shall be stated in the certificate.
The tests and requirements shall be in accordance with OCIMF, 2000.
If alternative test standards are requested to be used, the appropriate test programme shall be evaluated by the Society. Acceptance of the test standard shall be given before testing.

4.4 Extent of testing at renewal

For all alternatives in [4.3], i.e. testing of fibre rope either based on ISO 2307, OCIMF or other standards, the extent of testing at renewal is listed in Table 3.

For testing in connection with renewal of the TA, at least one of the dimensions (diameters) for testing shall be different from the dimensions tested in connection with the initial type test and previous renewals.

Guidance note:
Recent well documented tests (e.g. in connection with product certification, etc.) carried out by the manufacturer may be considered partly or fully as an alternative to the above required testing at renewal.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---
### Table 3 Requirements to type testing of synthetic fibre ropes

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>Number and selection of parallels</th>
<th>Unit</th>
<th>Definition of value</th>
<th>Level of verification</th>
<th>Frequency of verification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alternative 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net mass per metre 1)</td>
<td>Min 5 parallels</td>
<td>Kilotex</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lay length</td>
<td>Min 5 parallels</td>
<td>m</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plait pitch 2)</td>
<td>Min 5 parallels</td>
<td>m</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter and/or circumference</td>
<td>Min 5 parallels</td>
<td>m</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breaking strength 3)</td>
<td>See [4.3] Alternative 1</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation</td>
<td>See OCIMF, 2000 and 3.4.2 Alternative 2</td>
<td>%</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alternative 2, OCIMF, 2000</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New dry break test (NDBS) 4)</td>
<td>See OCIMF, 2000</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New wet break test (NWBS) 4)</td>
<td>See OCIMF, 2000</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclic load test 5)</td>
<td>See OCIMF, 2000</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elongation and extension measurements</td>
<td>See OCIMF, 2000</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alternative 2, Other Standards</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As given in test standard</td>
<td>International or national test standard</td>
<td>N</td>
<td>individual mean</td>
<td>Initial Renewal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1) Fibre ropes manufactured according to this type approval shall have a net mass per meter equal to the value stated on the certificate ± 5%

2) originally required for compliance with EN 919 (1995), which is later replaced by ISO 2307

3) initial setting of the rope, inclusive splices, by cyclic loading prior to testing of breaking strength shall be carried out in accordance with test standard. Testing of breaking strength shall be carried out with a monotonously increasing load until failure of the rope. Any test piece which breaks outside the marks (i.e. in the splice area) is considered to comply with the tensile strength specifications if the force recorded on breakage is not less than 90% of the minimum specified breaking strength. The location of the failure and the breaking force recorded during the test shall be reported

4) initial setting of the rope shall, after having been loaded to the reference load, be carried out by cycling the rope ten times from the reference load to 50% of its estimated NDBS and NWBS, respectively, at a suitable loading rate not less than 5% of the overall specimen length per minute with no rest between cycles

5) the manufacturer might elect not to test this item. However, cyclic load testing is recommended for synthetic fibre ropes to be used in applications subject to cyclic loading

Legend:

Mean = arithmetic mean of type test results
Minimum = minimum of type test results
Individual = individual of type test results
Initial = initial assessment
Renewal = periodical assessment, carried out after five (5) years

5 Requirements to marking of product

The product or package shall be marked. The marking shall at least include the following information:
— manufacturer’s name and address or trade mark
— production plant
— product name (grade)
— storage instruction
— production date/batch number
— quality guarantee period, if any.

The marking shall be carried out in such a way that it is visible, legible and indelible. The marking of product shall enable traceability to the type approval certificate.
CHANGES – HISTORIC

There are currently no historical changes for this document.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.